

DOCKET NO.: CARP-0087
Application No.: 09/746,219
Office Action Dated: November 3, 2004

PATENT
REPLY FILED UNDER EXPEDITED
PROCEDURE PURSUANT TO
37 CFR § 1.116

Amendments to the Drawings

The attached sheet(s) of drawings includes changes to Fig(s) 1 through 6. The sheet(s), which includes Fig(s) 1 through 6, replaces the original sheet(s) including Fig(s) 1 through 6 .

Attachment: Six (6) Replacement Sheet(s)

REMARKS

Status of the Claims

Claims 1 through 36 are pending in the instant application. None of the claims are amended in this response. No new matter has been added. In the Office Action dated November 3, 2004, claims 1-10, 15, 17-26, and 34 were rejected, and claims 11-14, 16, 27-33, 35 and 36 were objected to.

In view of the following remarks, Applicants respectfully request withdrawal of all claim rejections and objections upon reconsideration.

The Present Invention

The present invention relates to a catalyst support for selective gas phase reactions in a tubular reactor, wherein the catalyst support comprises a metallic monolith having channels adapted to receive a catalytically active phase or an intermediate layer acting as a carrier for the catalytically active phase.

Claim Objections

The Office Action advises that, should claim 26 be found allowable, claim 34 will be objected to as allegedly being a substantial duplicate thereof. Applicants disagree, as claim 26 is directed to gas phase *exothermic* reactions, whereas claim 34 is directed to gas phase *endothermic* reactions. Applicants respectfully submit that claims 26 and 34 are not "so close in content that they both cover the same thing" (Office Action at page 2), as each is directed to a different class of reaction.

The Office Action further states that claims 11-14, 16, 27-33, and 35-36 are objected to as being dependent on a rejected base claim. Applicants submit that the arguments below demonstrate the allowability of the rejected claims and thus render the Examiner's objection to the above-listed claims unnecessary.

Accordingly, Applicants respectfully request withdrawal of all claim objections in the present application.

Claim Rejections

Rejections Under 35 U.S.C. §102(b)

Claims 1 through 3 and 6 have been rejected under §102(b) as being allegedly anticipated by Hershkowitz et al. (US Pat. No. 5,883,138). (Office Action at page 2.) The Office Action states that “Hershkowitz et al. discloses a metallic monolith catalyst in which the fluid flow is parallel to the catalyst axis. The catalytically active metal may be in a variety of forms, one being a monolith. Figure 3 demonstrates the irregular shape of the cell perimeter.” (*Id.* At page 3.) Applicants respectfully traverse this rejection.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of Calif.*, 814 F.2d 628, 631 (Fed. Cir. 1987); MPEP §2131. The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236 (Fed. Cir. 1989); MPEP §2131. Based upon these guidelines, Hershkowitz does not anticipate claims 1-3 and 6 of the present application.

As set forth in claim 1, the present invention comprises a metallic monolith catalyst support for *selective gas phase reactions*. Hershkowitz, on the other hand, describes in large part a premixing apparatus that premixes reagents at high velocities before injecting them into a reaction zone containing a catalyst retained in a fixed arrangement.¹ According to Hershkowitz, it is this premixing at high velocity, along with a relatively high pressure drop through the mixer, that forces the reaction to favor a desired stoichiometry once injected into the reaction zone. (Hershkowitz at col. 5, lines 1-5.) Hershkowitz does not disclose or suggest that the characteristics of a monolithic catalyst support structure affect the selectivity of the reactions described therein. In contrast, it is the structure of the monolith support itself in the present invention which affects selectivity of the gas phase reactions that take place within the structure. Because the metallic monolith is at the same time the support for catalytically active material and the medium for efficiently removing the heat of reaction (thus minimizing hot spots), catalyst deactivation is prevented or slowed thereby increasing

¹ Very little of the disclosure of Hershkowitz is directed to describing the structure and use of this reaction zone. The vast majority of the disclosure of Hershkowitz is directed to discussion of the structure and operation of the premixer/injector apparatus claimed therein.

selectivity of reactions. (See specification as originally filed at, *inter alia*, page 4, lines 6-9 and page 6, lines 27-30.)

One skilled in the art will appreciate that the properties of selective and non-selective reactions are entirely different, and therefore would not contemplate using a catalyst support for non-selective reactions in a selective reaction. Very often, the technology used in selective reactions is unsuitable for use in non-selective reactions, and vice-versa.

Because Hershkowitz does not describe or suggest a monolith support structure suitable for performing *selective* gas phase reactions, an element of pending claim 1 (and therefore also an element of dependent claims 2, 3, and 6), Hershkowitz does not anticipate the claimed invention. Accordingly, Applicants respectfully request withdrawal of the claim rejections based on §102(b).

Rejections Under 35 USC §103(a)

Claims 4-5, 7-10, 15, 17-26, and 34 have been rejected under §103(a) as allegedly being rendered obvious by Hershkowitz in view of Matros (US Pat. No. 6,314,722). The Office Action alleges that “Hershkowitz et al. demonstrates the irregular shape of the cell perimeter, but not regular shapes such as square, triangular, hexagonal, or circular. Matros et al. discloses a monolith catalyst, which has a square, circular, cylinder, or ring shape.” (Office Action at page 3.) The Office Action further asserts that “it would have been obvious to one of ordinary skill in the art at the time of the invention to use different cell shapes, materials, and dimensions, as taught by Matros et al. in the Hershkowitz et al. monolith catalytic system because different cell shapes, materials, and dimensions allow the flow conditions and hence reaction kinetics to be tailored to the required process.” (*Id.* at page 4) Applicants respectfully traverse this rejection.

To establish a *prima facie* case of obviousness, three basic criteria must be met:

First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

MPEP §2142. Claims 4-5, 7-10, 15, 17-26, and 34 of the present invention are not rendered obvious by the cited references because there is no suggestion or motivation to combine the cited references.

Claims 4 and 5:

Claims 4 and 5 define the shape of cells formed within a monolith catalyst support. The Office Action cites Figure 3 of Hershkowitz to support the assertion that the reference demonstrates an irregular-shaped cell perimeter. Figure 3, however, “is a plan view of the face and certain channels beneath the face surface of a multi-nozzle injector as illustrated in Fig. 1.” (Hershkowitz at col. 8, lines 65-67.) Therefore, Figure 3 depicts the injector described by Hershkowitz that is used for premixing reactants before injection into a monolithic catalyst structure. It does *not* depict the shape of cells within a monolithic catalyst support itself. Not only does Hershkowitz fail to depict the shape of cells within a monolithic catalyst support, it also fails to disclose cells within a monolith support altogether, regardless of their shape. As such, there is no motivation or suggestion for one of skill in the art to seek to combine Hershkowitz with a reference describing regularly-shaped cells within a monolithic structure.

Further, Matros does not, as asserted by the Office Action, disclose square, circular, cylinder, or ring shapes of cells within a monolith. As set forth in column 4, line 38 of the Matros reference, the shapes listed in the Office Action are discussed as possible shapes for “gas-permeable solid material... provided as a randomly packed material,” i.e., conventional catalyst pellets. Therefore, even if one were to combine Hershkowitz with Matros, the result would not be a metallic monolith catalyst support having cells with regular shapes.

Similarly, as discussed previously, Hershkowitz teaches the use of a premixer/injector to achieve the desired reaction conditions and mechanism once inside the reaction zone. The disclosure of Hershkowitz does not suggest that selectivity of gas phase reactions is affected by the structure of a monolithic catalyst support, nor does it suggest that the inclusion of cells within a monolith will affect reaction kinetics. As such, there is no motivation to look to Matros, or any other reference, to seek different cell shapes to “allow the flow conditions and hence reaction kinetics to be tailored to the required process.” (Office Action at page 4.)

Claims 7-10:

Claims 7-10 further describe the properties of the cells within the monolith structure. As discussed above, Hershkowitz fails to disclose cells within a monolith support, and further does not suggest that selectivity of gas phase reactions is affected by the structure of a monolithic catalyst support. Hershkowitz also does not suggest that the inclusion of cells within a monolith will affect reaction kinetics. Therefore, there is no motivation to look to Matros to configure cells within a monolith catalyst support, nor would there be an expectation of success when doing so.

Claims 15, 17-26, and 34:

The remaining rejected claims, 15, 17-26, and 34, are also not rendered obvious by Hershkowitz in combination with Matros because both references are directed to *non-selective* gas phase reactions. In contrast, all of claims 15, 17-26, and 34 are directed to *selective* reactions, either directly or indirectly through their dependence on a preceding claim.

As mentioned previously, Hershkowitz relates to a system of injectors designed to obtain a particular fluidodynamic regime in the reaction zone, for example to ensure good mixing of reagents and short residence time in the reaction zone. Very little of the disclosure is directed to describing the structure and use of the reaction zone itself. Hershkowitz does not disclose or suggest that the characteristics of a monolithic catalyst support structure affect the selectivity of the reactions described therein.

Similarly, Matros is devoted to the disclosure of a converter for purifying exhaust gases, and particularly for controlling NO_x and soot emissions. The reactions described by Matros are *non-selective*.

A skilled person concerned with providing an improved catalyst for selective gas-phase exothermic reactions would not even consider either the Hershkowitz or Matros references, as they relate to completely different technical problems, and the technology used in non-selective reactions is generally not adaptable for use in selective reactions. Therefore, no *prima facie* case of obviousness has been established by the Office Action because there is no motivation to combine the cited references for use in selective gas-phase reactions and, even if the references were combined, they would not teach or suggest all of the limitations of the pending claims because they do not disclose the use of a metallic monolith catalyst support in selective gas-phase reactions.

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The Office Action has failed to provide any motivation to combine and/or modify the cited references so as to render the present claims obvious and, therefore, has failed to satisfy all three criteria required for a *prima facie* case of obviousness. *In re Rouffet*, 47 USPQ2d 1453, 1457-8 (Fed. Cir. 1998) (“To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.”) Therefore, Applicants respectfully request reconsideration and withdrawal of the claim rejections under §103(a).

Conclusion

In light of the foregoing amendments and remarks, Applicants respectfully request withdrawal of all claim objections and rejections and allowance of the pending claims. Applicants invite the examiner to contact the undersigned at (215) 557-5966 to clarify any issues not resolved by this response.

Date: May 3, 2005

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